

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF AERONAUTICS - STANDARD SPECIFICATION
P-154
Subbase Course

DESCRIPTION

1.1 This item shall consist of a subbase course composed of granular materials constructed on a prepared subgrade or underlying course in accordance with these specifications, and in conformity with the dimensions and typical cross section shown on the plans, and with the lines and grades established by the Engineer.

MATERIALS

2.1 Materials. The subbase material shall consist of hard durable particles or fragments of granular aggregates. This material will be mixed or blended with fine sand, clay, stone dust, or other similar binding or filler materials produced from approved sources. This mixture must be uniform and shall comply with the requirements of these specifications as to gradation, soil constants, and shall be capable of being compacted into a dense and stable subbase. The material shall be free from vegetable matter, lumps or excessive amounts of clay, and other objectionable or foreign substances. Pit-run material may be used, provided the material meets the requirements specified.

*Not Specified, however, the liquid limit and plasticity index will be determined from that portion passing the No. 40.

Subbase of less than nine inches in thickness shall consist of Type No. 1 material. Subbases of nine or more inches in thickness shall have the top 1 inch of Type No. 1 material with the balance consisting of Type No. 2 material, unless otherwise specified on the plans.

The portion of the material passing the No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 6 when tested in accordance with ASTM D 4318.

Not more than 3% of the material shall be finer than 0.02 mm in diameter, as determined by testing in accordance with ASTM D422.

CONSTRUCTION METHODS

3.1 General. The subbase course shall be placed where designated on the plans or as directed by the Engineer. The material shall be shaped and thoroughly compacted within the tolerances specified.

TYPE	MATERIAL	Sieve designation (sq. openings) ASTM C117 and C136-Percent Passing					% Loss by
		1"	3/8"	No. 8	No. 10	No. 40	Washing
No. 1	Aggregate 24A	100	60-85	30-55		*	3-7
No. 2	Sand	100			20-100	5-60	3-10

Granular subbases which, due to grain sizes or shapes, are not sufficiently stable to support without movement the construction equipment, shall be mechanically stabilized to the depth necessary to provide such stability as directed by

the Engineer. The mechanical stabilization shall principally include the addition of a fine-grained medium to bind the particles of the subbase material sufficiently to furnish a bearing strength, so that the course will not deform under the traffic

of the construction equipment. The addition of the binding medium to the subbase material shall not increase the soil constants of that material above the limits specified.

3.2 Operation in Pits. All work involved in clearing and stripping pits and handling unsuitable material encountered shall be performed by the Contractor at his/her own expense. The subbase material shall be obtained from pits or sources that have been approved. The material in the pits shall be excavated and handled in such manner that a uniform and satisfactory product can be secured.

3.3 Equipment. All equipment necessary for the proper construction of this work shall be on the project, shall be in first-class working condition, and shall have been approved by the Engineer before construction is permitted to start.

Provision shall be made by the Contractor for furnishing water at the site of the work using equipment of ample capacity and design to assure uniform application.

The processing equipment shall be designed, constructed, and operated and shall have sufficient capacity to thoroughly mix all materials and water in the proportions required to produce a subbase course of the gradation and consistency required.

To protect the subgrade and to insure proper drainage, the spreading of the subbase shall begin along the centerline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

3.4 Preparing Underlying Course. Before any subbase material is placed, the underlying course shall be prepared and conditioned as specified. The course shall be checked and accepted by the Engineer before placing and spreading operations are started.

Grade control between the edges of the pavement shall be by means of grade stakes, steel pins, or forms placed in lanes parallel to

the centerline of the pavement and at intervals which will permit string lines or check boards to be placed between the stakes, pins, or forms.

3.5 Materials Acceptable in Existing Condition. When the entire subbase material is secured in a uniform and satisfactory condition and contains approximately the required moisture, such approved material may be moved directly to the spreading equipment for placing. The material may be obtained from gravel pits, stockpiles, or may be produced from a crushing and screening plant with the proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. It is the intent of this section of the specifications to secure materials that will not require further mixing. The moisture content of the material shall be approximately that required to obtain maximum density. Any minor deficiency or excess of moisture may be corrected by surface sprinkling or by aeration. In such instances, some mixing or manipulation may be required, immediately preceding the rollings, to obtain the required moisture content. The final operation shall be blading or dragging, if necessary to obtain a smooth uniform surface true to line and grade.

3.6 Plant Mixing. When materials from several sources are to be blended and mixed, the subbase material shall be processed in a central or travel mixing plant. The subbase material, together with any blended material, shall be thoroughly mixed with the required amount of water. After the mixing is complete, the material shall be transported to and spread on the underlying course without undue loss of the moisture content.

3.7 Mixed In Place. When materials from different sources are to be proportioned and mixed or blended in place, the relative proportions of the components of the mixture shall be as designated by the Engineer.

The subbase material shall be deposited and spread evenly to a uniform thickness and width. Then the binder, filler, and other material shall be deposited and spread evenly over the first layer. There shall be as many layers of materials added as the Engineer may direct to obtain the required subbase

mixture.

When the required amount of materials have been placed, they shall be thoroughly mixed and blended by means of approved graders, discs, harrows, rotary tillers, supplemented by other suitable equipment if necessary. The mixing shall continue until the mixture is uniform throughout. Areas of segregated material shall be corrected by the addition of binder or filler material and by thorough remixing. Water in the amount and as directed by the Engineer shall be uniformly applied prior to and during the mixing operations, if necessary, to maintain the material at its required moisture content. When the mixing and blending has been completed, the material shall be spread in a uniform layer which, when compacted, will meet the requirements of thickness and typical cross section.

3.8 General Methods for Placing The subbase course shall be constructed in layers. Any layer shall be not less than 3 inches nor more than 8 inches of compacted thickness. The material, as spread, shall be of uniform gradation with no pockets of fine or coarse materials. The subbase, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square yards in advance of the rolling. Any necessary sprinkling shall be kept within this limit. No material shall be placed in snow or on a soft, muddy, or frozen course.

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

During the placing and spreading, sufficient caution shall be exercised to prevent the incorporation of subgrade, shoulder, or foreign material in the subbase course mixture.

3.9 Finishing and Compacting. After spreading or mixing, the subbase material shall be thoroughly compacted by rolling and sprinkling, when necessary. Sufficient rollers shall be furnished to adequately handle the rate of placing and spreading of the subbase course.

Rolling shall progress gradually from the sides to the center of the lane under construction, or from one side toward previously placed material, by lapping uniformly each preceding track by at least 12 inches. The rolling shall continue until the material is thoroughly set and stable, and the subbase material has been compacted to not less than 100% of maximum density at optimum moisture as determined by the compaction control tests specified in FAA T-611. The maximum density is reduced to 95% when the pavement structure is designed for aircraft of less than 12,500 pounds gross weight. The design gross weight will be as shown on the plans. Blading and rolling shall be done alternately, as required or directed, to obtain a smooth, even, and uniformly compacted subbase.

The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the subbase. When the rolling develops irregularities that exceed $\frac{1}{2}$ inch when tested with a 16-foot straightedge, the irregular surface shall be loosened and then refilled with the same kind of material as that used in constructing the course and again rolled as required above.

Along places inaccessible to rollers, the subbase material shall be tamped thoroughly with mechanical or hand tampers.

Sprinkling during rolling, if necessary, shall be in the amount and by equipment approved by the Engineer. Water shall not be added in such a manner or quantity that free water will reach the underlying layer and cause it to become soft.

3.10 Surface Test. After the course is completely compacted, the surface shall be tested for smoothness and accuracy of grade and crown; any portion found to lack the required smoothness or to fail in accuracy of grade or crown shall be scarified, reshaped, recompacted, and otherwise manipulated as the Engineer may direct until the required smoothness and accuracy are obtained. The finished surface shall not vary more than $\frac{1}{2}$ inch when tested with a 16-foot straightedge applied parallel with, and at right angles to, the centerline.

3.11 Thickness. The thickness of each type of completed subbase course material shall be determined by elevations taken to the nearest 0.01 foot, at intervals not exceeding 50 feet, using the method of setting finished grade stakes. The thickness shall be verified by the Contractor, at his expense, by the taking of cores or depth tests in the presence of the Engineer. Cores or depth tests shall be taken at intervals of not less than one per 3000 square yards of each type of material placed. The thickness of the Type No. 2 subbase material shall be determined prior to the placing of the Type No. 1 material. When deficiencies in excess of ½ inch are noted, the Contractor shall make such additional cores or depth tests, as required by the Engineer, to determine the extent of the deficiency.

Replacement and compaction of subbase material removed for test purposes shall be accomplished by the Contractor, at his expense.

Deficiencies in thickness in excess of ½ inch for each type of subbase material shall be corrected by the Contractor, at his expense, by scarifying, adding satisfactory mixture, rolling, sprinkling, reshaping and finishing in accordance with these specifications.

3.12 Protection. Work on subbase course shall not be conducted during freezing temperatures nor when the subgrade is wet. When the subbase material contains frozen material or when the underlying course is frozen, the construction shall be stopped.

3.13 Maintenance. Following the final shaping of the material, the subbase shall be maintained throughout its entire length by the use of standard motor graders and rollers until, in the judgement of the Engineer, the subbase meets all requirements and is acceptable for the construction of the next course.

METHOD OF MEASUREMENT

4.1 The quantity of subbase course to be

paid for, shall be the number of cubic yards, compacted measure, of each type of subbase course material placed, bonded, and accepted in the completed subbase course. The quantity of subbase course material shall be as measured in final position based on end areas of the completed work, computed from the elevations established to work, computed from the elevations established to the nearest 0.01 foot. No payment will be made for material placed in excess of the specified depth. Subbase materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

5.1 Payment shall be made at the contract unit price per cubic yard, compacted measurement for subbase course. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment shall be made under the nomenclature and seven digit item number specified in the plans and proposal for each type of subbase course required per cubic yard.

The first three digits of any item number for work included under this specification shall be 154, i.e. 154XXXX.

MATERIAL AND SHORT TITLE

Test and Short Title

ASTM	C117	Loss by Washing
ASTM	C136	Sieve Analysis
ASTM	D422	Particle Size
ASTM	D4318	Liquid Limit, Plastic Limit & P.I.
FAA	T611	Density